

CASE STUDY: EFFECTS OF SHUTTING DOWN A PUMP & TREAT SYSTEM AT AIR FORCE PLANT 4

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Introduction

Earth Tech conducted a Phase II RPO study on two systems at Air Force Plant 4 (AFP4): a dual-phase extraction system located at Landfill No. 3 (LF-3) that treats groundwater through air stripping and vapor through vapor-phase carbon, and a pump-and-treat system located at Fuel Saturation Area No. 1 (FSA-1) that treats groundwater through liquid-phase carbon. The Phase II RPO study included intensive evaluation to explore system optimization, new technologies, and regulatory opportunities. As part of the study, Earth Tech developed a comprehensive conceptual site model for the study area, determined that one of the systems was ineffective (unable to achieve remedial objectives), identified significant inefficiencies in the systems, developed decision rules for the operation of the systems, and made recommendations for optimization and operation of the systems. The results of the AFP4 Phase II RPO are presented in the *Final RPO Report* (Earth Tech, 2001).

Methods

LF-3 Dual-Phase Extraction System: The LF-3 system was installed as a voluntary action to “minimize contamination in the Terrace Alluvial groundwater that may discharge to Meandering Road Creek.” To achieve this goal, the system was operated from 1995 until 2001 to prevent seeps along a cliff face located adjacent to the southern area of the LF-3 system and Meandering Road Creek. However, seeps were identified along the cliff face in February 2001, and it was concluded that the seeps were likely active during the entire operational period of the system. A water sample from the seeps was collected in February 2001 and analyzed for VOCs; TCE was detected in the sample at an estimated concentration of 2.6J µg/L, and cis-1,2-DCE was detected in the sample at an estimated concentration of 0.92J µg/L. As a result of this finding and because there were minimal system performance data available, Earth Tech recommended fieldwork to generate the data (analytical, water level, DNAPL thickness, etc.) necessary to update the conceptual site model (CSM) and evaluate the treatment system.

The RPO fieldwork consisted of the following:

- Collecting water level measurements, DNAPL thickness measurements, air flow rate measurements, and air and water (groundwater, seep, and creek) quality data in April 2001;
- Shutting down the LF-3 extraction system after the collection of the above data; and
- Collecting water level measurements, DNAPL thickness measurements, and water (seep and creek) quality data one month after system shutdown (i.e., May 2001).

Based on the RPO data, site regulators (Texas Natural Resource Conservation Commission and USEPA) allowed the Air Force to keep the system down during the Phase II RPO study. As a result, IT Corp. collected seep and creek samples on a monthly basis to monitor seep and creek concentrations. With the data generated during the RPO fieldwork and subsequent seep and creek sampling events, the CSM was updated and the treatment system was evaluated in detail. The *Final RPO Report* presented the following conclusions about the LF-3 system:

- The system did not achieve its remedial objective (i.e., prevent the seeps);
- The system did not prevent contamination in the seeps (analytical data from samples collected before and after system shutdown indicated the system had minimal impact on seep and creek water quality);
- The system had limited ability to extract water from the northern area of the system (where DNAPL and high-concentration dissolved-phase contamination exists);
- The system did extract water from the southern area of the system (where little/no contamination exists);
- The system potentially pulled contamination (DNAPL/dissolved-phase) toward the plant boundary.

Based on the RPO findings, the *Final RPO Report* identified two potential operating options for the LF-3 system, including: 1) keeping the LF-3 system down and establishing action levels to trigger future operation of an optimized LF-3 system, and 2) operating an optimized LF-3 system. The *Final RPO Report* provided detailed

optimization recommendations (e.g., replacing the vacuum-enhanced pumping system with a pneumatic pumping system, decreasing the number of extraction wells from 48 wells to the 6 most contaminated wells), established decision rules, presented flowcharts (see Figure 1), and summarized potential benefits for both operating options. Following a detailed evaluation of both operating options, the *Final RPO Report* recommended Option 1 (keeping the system down) for the following reasons:

- As long as the system is down (i.e., as long as creek concentrations remain below the high-concentration action levels; see Figure 1), the possibility of pulling DNAPL and/or dissolved-phase contamination toward the system and plant boundary is eliminated.
- As long as the system is down, O&M costs associated with the system are eliminated.
- Regardless of whether or not the LF-3 system operates, the FSA-1 system will continue to operate and remove contamination from two French drains located upgradient of the LF-3 system.
- VOC concentrations in Meandering Road Creek were below MCLs prior to system shutdown (April 2001), and remained below MCLs during each subsequent sampling event (May through October 2001).
- For the most part, VOC concentrations in seep samples were at or below the daily average required by the Meandering Road Creek surface water discharge permit (TCE at 85 µg/L); no detections exceeded the daily maximum for TCE (181 µg/L). The daily average and maximum TCE concentrations are based on daily total flow rates of 155 gpm and 347 gpm, respectively, which are significantly higher than total flow from the seeps. Therefore, total mass of contamination discharging to the creek through the seeps is significantly lower than that allowed by the surface water discharge permit.
- The DNAPL (and dissolved-phase contamination) beneath LF-1 and LF-3 had minimal impact on Meandering Road Creek, despite a long residence time.
- The cost to operate the system per pound removed is unreasonably high.

FSA-1 Pump-and-Treat System: The FSA-1 system is a pump-and-treat system that treats groundwater from two French drains installed in the Terrace Alluvium and one groundwater recovery well screened in the Upper Paluxy aquifer. Water is treated through adsorption in two 10,000-pound GAC units and discharged to Meandering Road Creek. This system is simple and effective in its approach to treatment, and showed little opportunity for improvement during the Phase II RPO study. A review of the hydraulics of the French drains did indicate these systems were experiencing some efficiency loss, resulting in lower-than-expected calculated flows. Consequently, the *Final RPO Report* recommended the following optimization tasks for the FSA-1 system:

- Continued optimization of the constant-rate pumping scheme (to keep the gravel pack free from sediment); and
- Removing the biofouling/sediment from the gravel pack.

Results

Based on the conclusions and recommendations presented in the *Final RPO Report*, site regulators allowed the Air Force to keep the LF-3 system (which had an annual O&M cost of approximately \$335,000 per year) down. As a result, depending on whether or not the action levels (for Meandering Road Creek) defined in the *Final RPO Report* are exceeded, the Air Force will recognize savings of between \$1.7 million and \$4.2 million over 10 years (at 5% inflation). [Note: these figures do not account for future monitoring costs.]

Since the RPO was completed in December 2001, the following data have been collected to support the RPO recommendation to discontinue the operation of the LF-3 system: 1) IT Corp. (2002) has collected seep and creek samples on a monthly basis, and 2) Earth Tech has sampled the LF-3 system extraction wells twice (May and October 2002). The extraction well, seep (see Figure 2), and creek (see Figure 3) analytical data all indicate that VOC concentrations have remained relatively constant since the system was shut down in April 2001, thereby providing evidence that the shutdown of the system has not adversely impacted the groundwater, creek, or seeps.

References

Earth Tech, December 2001, *Final Remedial Process Optimization Report for Landfill No. 1 and Fuel Saturation Area No. 1 at Air Force Plant 4*.

IT Corporation, December 2002, *Summary Meandering Road Creek and Landfill No. 3 Seep Water Sample Analytical Update*.

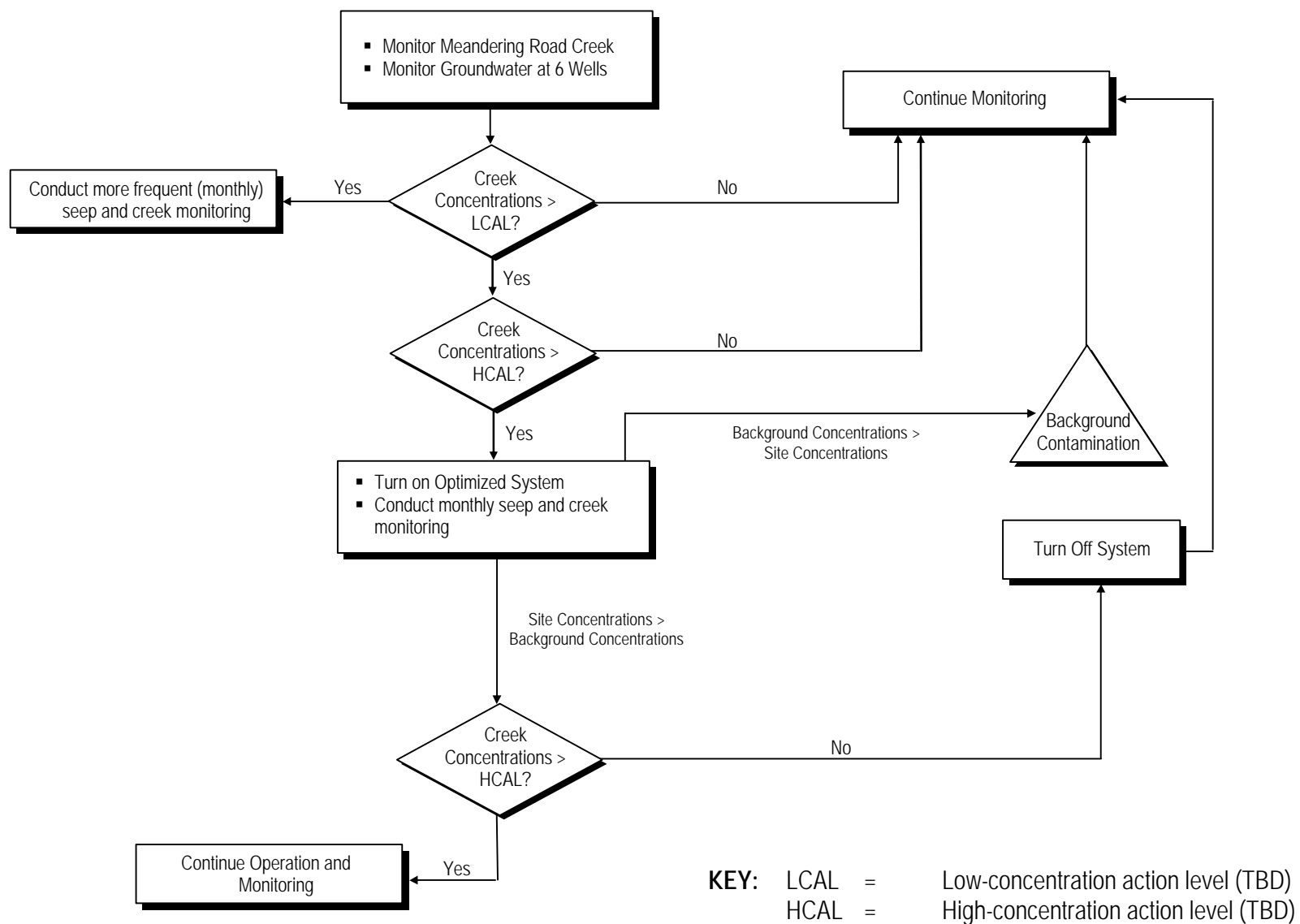


Figure 1. Flowchart for Option 1 (Keep the System Down)

Figure 2. TCE Concentrations in Seep Samples

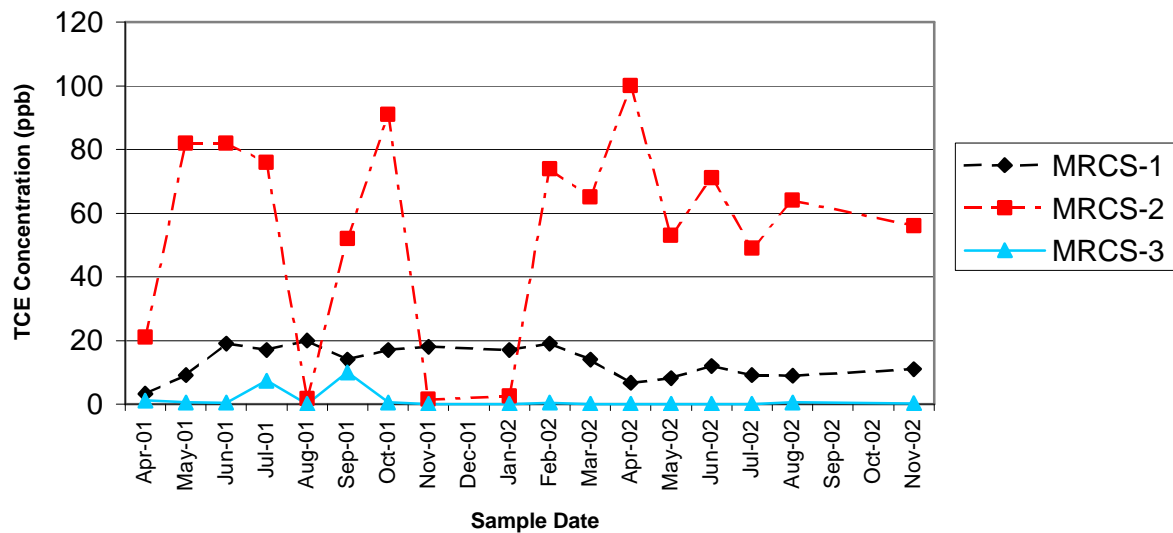


Figure 3. TCE Concentrations in Creek Samples

